Section 16
Monitoring and Control

The purpose of this section is to establish a monitoring and control strategy for the Potable Water and Wastewater Master Plan for Tijuana and Playas de Rosarito. Presented in this section are general ideas to be developed in coordination with CESPT. Through the implementation of this strategy a result that is compatible with the General Purpose of the Project will be obtained. The objective is:

> *To produce a dynamic document that defines an integral strategy for water and sanitation services in the study area allowing CESPT to assist in meeting the public health, quality of life, and environmental protection needs of present and future generations.*

The task of monitoring and control is important because it represents a tool to measure the progress of the master plan. With the help of this tool, CESPT will be able to make the necessary adjustments at the appropriate time, anticipating the needs and demands of services. On the other hand, when updating the master plan, care should be taken to develop a document that effectively demonstrates a flexible structure and the capability of assimilating the demands of these two important municipalities.

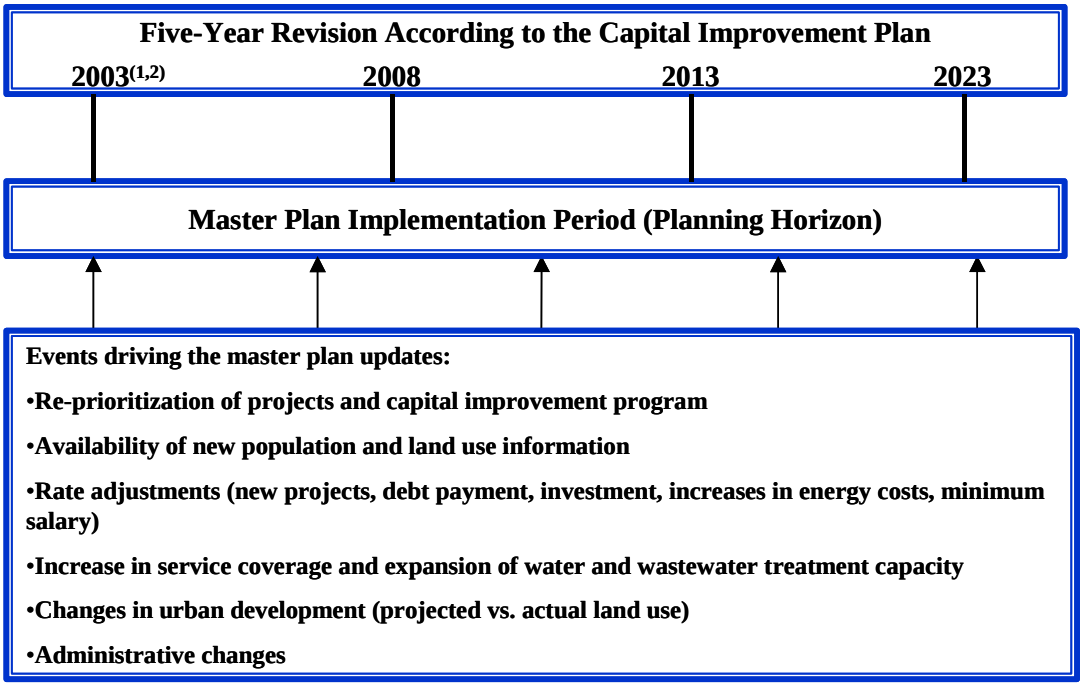
This section presents elements for follow up and control corresponding to two work areas: a) document (master plan) update; and b) follow up for the elements and projects to be implemented as a result of the master plan. These two areas are very different but both of them constitute an important part for the follow up and control of the activities delineated in the master plan.

Additionally, Section 16.6 includes specific actions for an industrial pretreatment program (which costs were presented in Section 14). This program represents and important element in the follow up and control, specifically related to the sanitation goals of CESPT.

16.1 Planning and Objectives

In this section, an assessment protocol for the effectiveness of the master plan is developed. The objective is to determine if all of the proposed improvements, as part of the investment plan, are being implemented according to the scheduled timetable. This flexible assessment system has as its first priority the optimization of the implementation of the master plan. In addition, the delineated protocol in this section is intertwined with the most noteworthy aspects of the master plan implementation, which are mentioned in Section 12.2.

A chronological representation is shown in Figure 16-1, which conceptualizes triggers for master plan updates.



(1) First year of the implementation period
(2) Development of preliminary financial analysis

Figure 16-1
Triggers for Updating Master Plan Tasks

One of the principal tasks that will lead to the effective implementation of the master plan is the identification of financing sources. As indicated in Figure 16-1, CESPT should establish the goal of completing a preliminary financial analysis during the first year of the plan implementation. Section 14 explains the importance and benefits of developing this financial analysis.

An important objective in the development of the follow up program is to use CESPT's resources to the maximum extent. CESPT's current capacity will need to be maximized, since it is not the purpose of this task to increase bottlenecks for the effective implementation of the master plan recommendations. In other words, the plan should not require the unjustified and unnecessary diversion of human resources for the formulation and implementation of the necessary activities for monitoring the plan.

The evaluation process of the effectiveness of the master plan should consist of a series of easily executable steps, clearly defined within a chronological context congruent with the investment plan. The steps that should be included in such process are presented below.

1. Assignment of staff responsible for the administration of the master plan

2. Inventory of projects and improvements undertaken stemming from the master plan

3. Identification of tasks following the capital improvements program

4. Comparison between completed tasks and capital improvements program

5. Updating of planning basis

6. Evaluation of improvements undertaken as compared to goals accomplished, based on performance measures

In the first instance a series of performance indicators to measure the master plan effectiveness according the project implementation in the short- mid- and long-term is presented.

Assessment Measures

In Section 12.2 a series of indicators and objectives were identified, which were developed during the sustainable development workshops. The components included in Table 12-24 will be taken as reference points for the formulation of the monitoring plan.

The objectives of the master plan that are listed below were weighted during the integration and evaluation of alternatives. These should be taken into account during the useful life of the master plan to determine its effectiveness.

- Protection of public health
- Provision of services in a cost-effective manner
- Reduction of impacts on the environment
- Promotion of a water conscious mindset
- Minimization of implementation risks
- Reduction of wastewater discharge to transboundary water courses
- Diversification of supply sources
- Minimization of the risks associated with operational wastes (e.g. sludge)
- Maximization of wastewater reuse
- Water conservation and leak reduction
- Sustainable management of aquifers

The factors listed above are complemented by the following components, which are also from Table 12-24. These will be taken into consideration when developing the monitoring program of the master plan.

- Impact on the quality of receiving waters
- Impact of nuisances (noises and offensive odors)
- Impact on endangered species and their habitat
- Coverage for the different planning milestones
- Water conservation programs
- Percentage of water contributed by main source
- Water loss reduction program
- Dissemination of educational materials
- Political risk, public acceptance and equity factors
- Relationship between extracted groundwater and artificial recharge of the aquifer
- Amount of water conservation in commercial and government buildings
- Amount and location of transboundary water discharge
- Impact of operational waste
- Percentage of effluent reused

After undergoing a screening process, which included the elimination of some objectives, and the grouping of others, the following performance indicators were proposed be used in the evaluation of the effectiveness of the master plan.

16.2 Performance Indicators

The performance indicators are a combination of the objectives and the sustainability criteria. These indicators will allow for the measurement of progress of each proposed improvement in the master plan, and will subsequently provide an assessment of its effectiveness.

- Water conservation
- Reduction of negative impacts on the environment
- Sustainable management of aquifers and diversification of supply sources

- Impacts on water quality of the receiving bodies
- Reuse of treated effluent
- Levels of coverage for the different planning horizons

It is important to point out that each of these indicators covers more than one objective and component. Additionally, it will be crucial to develop and maintain a database to record the progress of the master plan projects, based on the performance measures.

CESPT should generate this database specifically for the follow up of the master plan. This database should be simple and easy to update and should include variables that relate to the performance measures. For example, for water conservation (as a performance measure) the database should include information about estimates of physical and commercial losses, expenses related to education al programs about water conservation and water culture, estimates on water consumption and demand, etc. Information in the database will be valuable in the determination of the progress of the projects and programs recommended in the master plan. Formats presented in Section 16.5 will be useful in data collection.

The performance indicators are described below.

Water Conservation

This indicator will be implemented in order to reduce losses, both physical and commercial, and to reduce per capita consumption. Part of this effort consists of the dissemination and implementation of conservation awareness programs.

Reduction of Negative Impacts to the Environment

The objective of this indicator is to reduce negative impacts to the environment, ecosystems, and human life. Furthermore, it entails the reduction of impacts on endangered species. The measurement of these impacts can be done by using the state indicators for the environment, described in the environmental document for Dirección General de Ecología.

Sustainable Management of Aquifers

This indicator uses alternative water sources to prolong the life of the underground fresh water reserves, also focusing on the relationship between extracted groundwater and aquifer recharge in the study area.

Impacts on the Water Quality of the Receiving Bodies

The impacts that will be measured by this indicator include those caused to water quality by treated wastewater effluent flows discharged to receiving bodies.

Reuse of Treated Effluent

This indicator will evaluate the reuse of treated wastewater with the goal of evaluating the effectiveness of the master plan.

Coverage for the Different Planning Horizons

As was mentioned in Section 11, the capital improvement program considers the following planning periods: 1) 5 years; 2) 10 years; 3) 15 years; and 4) 20 years. The planning periods are 20 and 40 years for aqueducts. These time periods allow for improvements in the potable water, wastewater and reuse infrastructure. This indicator will determine real progress achieved and compare it to the projected progress from the master plan. External factors will only be identified to explain why the goal was not achieved.

The revisions to the list of proposed improvements should be done according to the planning periods described here. Likewise, in view of the fact that the effectiveness of the proposed improvements will be subject to changes in the water supply, coverage and service demands, the master plan will be updated as new demographic information is generated, so that service demands are revised in a timely manner to maintain the projected coverage levels.

16.3 Performance Review and Information Basis

We recommend that the master plan continue to be evaluated and updated along with the planning periods described in this document. Listed below are the suggested times to review the master plan.

- Project progress (expansion of coverage, implementation of the recommended alternative)
- Re-prioritization of projects
- Census, adjustment on growth rates, update on users database and administrative changes
- Regulations
- Financial adjustments (rate adjustments, debt payment, investments)

Table 16-1 indicates the events that trigger the revision and update of the different master plan tasks. For example, the tasks corresponding to the evaluation of the current conditions should be updates whenever one of the following events occurs: 1) progress on project implementation for projects identified in the master plan, 2) Re-prioritization of projects.

Table 16-1
Events that trigger the Master Plan Updates

Section of the master plan subject to Update	Progress on Projects	Re-prioritization on Projects	Statistical Data (Population, Users Database) and Administrative Changes	Regulations	Financial Adjustments (Rates, Debts, Installments, Investments)
3	■	■			
5			■		
6	■	■		■	
7	■	■	■	■	
8	■	■			
9	■	■	■		
10	■	■			
11	■	■			
12	■	■			■
13	■			■	
14	■	■	■		■
15				■	

Section 3 – Assessment of Current Conditions
As the infrastructure improves in the Tijuana and Playas de Rosarito area, CESPT should update their comprehensive survey (*catastro*) and databases to prioritize the capital improvements required. Additionally, it is recommended that the commercial databases be updated regularly.

Section 5 – Population and Land Use Projections
Updating this section of the master plan is important since it represents the basis for projecting demands in the project area, and demand projections in turn are used to determine the infrastructure needs.

Section 6 – Service Demand Projections
This section presents historic consumption and demand projections for the planning period, and needs to be updated as shown in Table 16-1. Within this task, the update of the projections and actual figures on physical and commercial losses is important. Every goal achieved in the water conservation program needs to be recorded in the master plan follow up database and incorporated into de demand models.

Section 7 – Water Resources Requirements
This task will need to be updated as the water use information is updated, since this section deals with the water sources in the region and their relative use. Changes in demand projections will also generate a need for updating this section.

Section 8 – Wastewater Infrastructure Requirements
This section will need to be updated in parallel with population projections, population distribution data, increases in demand for services, and the extension of the collection system increasing the coverage.

Section 9 – Development of Water and Wastewater Alternatives
Prioritizing alternatives is one of the most important elements in a context of planning to determine the needs for capital investments. Thus, it is recommended that this task be reviewed and updated to account for the changes in the current conditions and the planning base. In essence, updating this section represents and update of the master plan itself. It is recommended that the master plan be updated in whole every 6 years. Updating the master plan should represent an effort of lesser magnitude than the development of the current document, since this one will be the base for future updates.

Section 10 – Water Supply System Analysis
The water distribution model plays an important role in the implementation of the master plan. To maximize the benefits of the model, it needs to be updated to account for changes in the distribution system. Additionally, periodic efforts of monitoring are recommended to allow for calibration of the model after model updates.

Section 11 – Wastewater Collection System Analysis
Evaluating the wastewater collection system is crucial to determine more precisely the needs for the system's expansion in parallel to the expansion of the water network. The model will also give important information regarding the wastewater treatment demand needs and the location of the increased demands in the study area.

Section 12 –Development and Evaluation of Integrated Alternatives

soon as specific goals in this program are met, such as the rehabilitation and replacement programs, the capital improvements plan will need to be updated.

The first update of the capital improvement plan will need to happen within the first two years of the implementation period, since the prioritization of the investment will need to take place after the completion of a financial analysis.

Section 15 –Institutional Framework
The legal department in collaboration with the planning department will need to update this section of the plan periodically as norms and regulations (federal, state and local) and international agreements are modified.

Table 16-2 shows recommended frequency for updating the master plan sections. Tasks 19 and 11 are shown as a continuous process since they represent the constant modifications and use of the hydraulic models.

Table 16-2
Guidelines for Updating the Master Plan Tasks (Years)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Task	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
3				■						■					■					■
5				■				■					■					■		
6				■				■					■					■		
7					■						■					■				
8					■						■					■				
9						■						■						■		
10																				
11																				
12						■						■						■		
13						■						■						■		
14	■		■			■						■						■		
15							■						■						■	

Despite the fact that the above mentioned review times are recommended, it is important to point out that the master plan could be evaluated and updated with greater frequency under other conditions and circumstances.

Additionally, the identification of financing sources, the public participation processes and the updating of environmental studies are fundamental to the updating and measuring of the master plan's effectiveness.

Process of Information Updating

The population and water demand projections for Tijuana and Playas de Rosarito for the three planning periods, 2008, 2013 and 2023, should be reviewed through a

coordinated process headed by CESPT. Other agencies should participate as part of a planning group or committee.

It is recommended that three years, at the latest, after the implementation of this master plan, a series of sessions be held to determine and evaluate the veracity of the population, potable water demand, and wastewater generation information, and the need for updating that information.

The objective of the first session of the review program is to reach a consensus in relation to the hypotheses that will be used during the updating process and which are necessary to project potable water demands and population data.

Information Distribution

Once CESPT has updated the information basis according to the hypotheses that come out of the first session, new demand and population projections will be distributed to the planning group. If necessary, a new timetable for the capital improvements program will also be distributed. In this way, consensus will be sought, not only for the hypotheses, but also for the new projections, if necessary. The purpose of distributing this information is to set up the interinstitutional planning group with clearly defined review bases.

Review and Validation of Information

At the end of the distribution of the demand and population projections, the planning group should be given a reasonable period to evaluate the projections and to issue a report ratifying their validation. Subsequently, the new population and demand projections will be incorporated into the master plan. Likewise, CESPT will update the capital improvements program.

16.4 Tools

The necessary tools to review the master plan include the same computer programs that were used for the creation of this plan, which in form part of the majority of CESPT's tools. Below is a list of tools that should be used during the review of the master plan.

- Hydraulic models for the water and wastewater collection systems
- Demand projection models
- Financial models for rate projections, expenses, investments and debt service
- Scheduling

Table 16-3 shows the tasks that could be subject to modification as a result in the adjustment in the models used for the different master plan tasks, and with changes in the official publication of new statistical data.

Table 16-3
Tools Associated to the Events Triggering Master Plan Updates

Mater Plan Section Subject to Revisions	Hydraulic Models	Demand Models	Financial Models	Scheduling	Telemetry	Census and Official Population and Economic Data
3						■
5						■
6	■	■		■	■	
7	■	■			■	
8	■	■			■	
9	■	■	■			■
10	■				■	■
11	■				■	■
12	■					■
13				■		
14		■	■			■

Below the different aspects that should be evaluated in the case CESPT were to decide to modify hardware platform and / or operating system are listed:

- Additional licenses
- Performance (Historical and Projected)
- Internal and External Compatibility
- Evaluation and Identification of Information System Programs
- Market Availability
- Improvement Requirements for Existing Equipment
- Program for Replacing and Updating Packages and Systems

- Evaluation and Identification of Personnel Needs
- Staff Training

16.5 Formats

According to the topics discussed in this section, we include three formats for water, wastewater and industrial pretreatment. The objective of these formats is to facilitate a continuous monitoring and data recording on the progress of the master plan implementation. Notwithstanding the simplicity of the fist two formats (water and sanitation), their main value will be in explicitly recognizing the different steps in project implementation. The cells will need to be filled by CESPT staff indicating the completion of the different phases. In the case of lack of information, staff will need to take action to gather the information and register any project drop out and the reasons for its elimination.

The third format could be used for registering activities related to the industrial pre-treatment program presented in Section 16.6.

Comisión Estatal de Servicios Públicos de Tijuana – CESPT Baja California Water and Wastewater Master Plan Follow Up and Control Program						
Progress Record on Water Projects	**Indicate Activity Completion (√)**					
Date: _____, 20_ _ . Verification on progress of the CIP described in Section 14 of the Master Plan	Facilities Plan	Design	Environmental Process	Public Participation	Secure Funding	Area Responsible
Name of Project Programmed for this Cycle						

Comisión Estatal de Servicios Públicos de Tijuana - CESPT Baja California Water and Wastewater Master Plan Follow Up and Control Program						
Progress Record on Wastewater Projects	**Indicate Activity Completion (√)**					
Date: _____, 20_ _ . Verification on progress of the CIP described in Section 14 of the Master Plan	Facilities Plan	Design	Environmental Process	Public Participation	Secure Funding	Responsible Area
Name of Project Programmed for this Cycle						

Comisión Estatal de Servicios Públicos de Tijuana - CESPT Baja California Water and Wastewater Master Plan Follow Up and Control Program						
Progress Record on Pretreatment Projects	**Indicate Activity Completion (√)**					
Date: _____, 20_ _ . Verification on progress of the Pretreatment Program Described in Section 16 of the Master Plan	Changes in Users Database	Visits	Inspection	Sampling	In Compliance with Regulations	Responsible
Name of the Program Participant						

16.6 Pretreatment Program

In the Cities of Tijuana and Playas de Rosarito there is a large concentration of industrial and commercial establishments, some of which discharge wastewater from their production processes into the sewer system, in addition to their sanitary discharges. This type of discharge has the potential of including toxic, corrosive or explosive substances, which can interfere with the operation and integrity of the wastewater collection, transmission and treatment system.

The most important potential impacts of the uncontrolled industrial and commercial discharges are: the obstruction of the sewer system (greases and oils), the corrosion of the sewer and sanitation system structures, the accumulation of explosive substances in the sewer system, the presence of substances dangerous to the operating personnel, the inhibition of biological processes at the treatment plants with a consequent failure to comply with the water quality standards for the discharge, and the accumulation of hazardous substances in the sludge from the plants.

It is evident that uncontrolled industrial and commercial discharges present risk to the integrity of the sewer and treatment system, to the security of the CESPT workers, and to the environment; therefore, CESPT should develop an adequate program to control discharges, as well as the legal means and the necessary financial resources for its implementation.

It is recommended to initiate the implementation of a two-step program for the control of discharges. The first step involves continuing pursuing the consolidation activities stated in the agreement between CESPT and the Dirección General de Ecología del Estado (State Office of Ecology), through which CESPT can obtain the authority to take a leadership role in the implementation and monitoring of the program, and to carry out the necessary penalty measures for the users who are in non-compliance with the program. The second step involves the preparation of a study with the following points:

1. Identification of the specific objectives and goals of the discharge control program
2. Analysis of the existing regulations
3. Identification of users subject to the discharge control program
    - 3.1 Census of users
    - 3.2 Census of CANACO, CANACINTRA and other organizations
    - 3.3 Preliminary characterization of users
    - 3.4 Prioritization of users subject to the program
    - 3.5 Preparation of a map with user locations
4. Characterization of users
    - 4.1 Census of users
    - 4.2 Census of CANACO, CANACINTRA and other organizations
    - 4.3 Administration of a survey
    - 4.4 Field visits and activities
5. Sampling and measurement
    - 5.1 Self-sampling
    - 5.2 Sampling in the sewer system

5.3 Sampling in the wastewater treatment plants

6. Identification of contaminants of interest (historical sampling in the WWTPs)

7. Evaluation, identification, and reduction of toxicity (Note: This is a requirement in the United States for operating agencies that do not comply with the established effluent toxicity limits. The methodology used for this evaluation could be useful for Tijuana, although the overlap with subsections 5 and 6 would have to be determined. This item gains greater relevance if the underwater outfall in the United States is used for discharge from Tijuana.)

8. Additional recommendations to the regulations

   8.1 Establishment of local discharge limits

   8.2 Prohibitions

9. Computer systems and information management

10. Implementation of plan

    10.1 Procedures

    10.2 Sampling (frequency, methods, criteria, analysis, validation)

    10.3 Site visits

    10.4 Notifications

    10.5 Research

    10.6 Mechanisms for applying fines and penalties

    10.7 Personnel requirements

    10.8 Equipment requirements

    10.9 Laboratory requirements

    10.10 Legal requirements

    10.11 Legislative requirements (collaboration with the Dirección General de Ecología, delegation of responsibilities)

    10.12 Training and updating of the program

    10.13 Financial requirements (budget)

11. Financing sources for program (initial cost and operational cost)

12. Monitoring, updating and documentation (report preparation)

Section 14 includes the costs of the pretreatment program.